TEMPORARY STORAGE METHOD AND DEVICE FOR LINEAR BODY

TECHNICAL FIELD

[0001] The present invention relates to a temporary storage method and device for temporarily storing an elongate linear body while forming a festoon.

BACKGROUND ART

[0002] As a temporary storage device for a linear body, the present applicant has recently proposed one as disclosed in JP-A-2002-316769. This device includes a plurality of freely rotatable upper rollers which are arranged on a straight line, having their rotary axes parallel to each other, and a plurality of freely rotatable lower rollers which are respectively arranged immediately below the spaces between the adjacent upper rollers and adapted to be relatively moved toward and away from the upper rollers, having their rotary axes parallel to those of the upper rollers, wherein the device forms a festoon by alternately and sequentially winding about the upper and lower rollers a linear body traveling in the longitudinal direction.

[0003] Further, in this known device, the upper and lower rollers are spaced from each other to the separation limit to provide the maximum length of the festoon so that the length of the linear body which is temporarily stored in the temporary storage device can be set substantially equal to the product of the circumferential length of a forming drum and the number of times of winding the linear body. By this, an excessive wind-off operation of the linear body from the temporary storage device can be avoided even when the winding speed of the linear body around the forming drum is increased to a value of not lower than 3.0 m/sec, for example, thereby preventing damage to the temporary storage device.

[0004] However, in such conventional temporary storage method/ apparatus for a linear body, since the length of the linear body which is temporarily stored is very large, the length of the temporary storage

device in the longitudinal direction (substantially equal to the distance between the upper roller at the upstream end and the upper roller at the downstream end) also becomes considerably large. Hence, there may arise a problem that assurance of the installation space in the existing equipment becomes difficult, due to the increased size of the entire device.

[0005] It is therefore an object of the present invention to provide a linear body temporary storage method and device which is compact and can be readily installed with respect to the existing equipment.

DISCLOSURE OF THE INVENTION

[0006] The present invention has been conceived so as to achieve such an object, and its constitution and functional effects will be described below.

[0007] (1) According to one aspect of the present invention, there is provided a temporary storage method for a linear body, wherein, in a plurality of temporarily storing means having: a plurality of upper rollers which are arranged parallel with each other in a lateral direction, have rotary axes parallel to each other and perform free rotation; and a plurality of lower rollers which are respectively arranged directly below spaces between adjacent upper rollers, capable of relatively moving toward and away from the upper rollers, have rotary axes parallel to those of the upper rollers and perform free rotation, the temporary storage method comprises: alternately and sequentially winding a linear body traveling in a longitudinal direction around the upper and lower rollers to form a festoon; leading the linear body fed from an outlet of one temporarily storing means of the adjacent temporarily storing means to an inlet of the other temporarily storing means by guiding means; and thereby allowing the same linear body to sequentially pass through all the temporarily storing means while forming the festoon.

[0008] With this aspect of the present invention, the plurality of temporarily storing means having the upper and lower rollers around which the linear body forming a festoon is alternately and sequentially

wound are arranged parallel with each other in a lateral direction and the linear body is led by the guiding means to the inlet from the outlet of the temporarily storing means adjacent to each other so that the same linear body sequentially passes through all the temporarily storing means while forming the festoon, and hence, when the temporarily stored linear body has the same length, the longitudinal length of the temporary storage device can be formed rather shorter than that of a conventional device and, more particularly, the longitudinal length of the temporary storage device can be shortened approximately to a length obtained by dividing the longitudinal length of the conventional device by the number of the temporarily storing means, whereby the temporary storage device can be generally formed compact and easily installed also in an existing equipment.

[0009] (2) According to another aspect of the present invention, there is provided a temporary storage device for a linear body, comprising: a plurality of temporarily storing means having a plurality of upper rollers which are arranged parallel with each other in a lateral direction, have rotary axes parallel to each other and perform free rotation, and a plurality of lower rollers which are respectively arranged directly below spaces between adjacent upper rollers, capable of relatively moving toward and away from the upper rollers, have rotary axes parallel to those of the upper rollers and perform free rotation, the temporarily storing means alternately and sequentially winding a linear body traveling in a longitudinal direction around the upper and lower rollers to form a festoon; and guiding means for guiding the linear body fed from an outlet of one temporarily storing means of the adjacent temporarily storing means to an inlet of the other temporarily storing means, wherein the same linear body is allowed to sequentially pass through all the temporarily storing means while forming the festoon.

[0010] The device according to this aspect of the present invention carries out the method of item (1) above, and provides the same effects and advantages as those of the method of item (1).

[0011] (3) The present invention further provides a temporary storage device for a linear body according to item (2) above, wherein the outlet and the inlet of the adjacent temporarily storing means are respectively provided at one end portion and the other end portion in the longitudinal direction of the temporarily storing means, the guiding means having outlet side and inlet side guide rollers which are respectively arranged in the vicinity of the outlet and the vicinity of the inlet of the temporarily storing means, have rotary axes arranged on the substantially horizontal same plane and have a straight line connecting axial centers being perpendicular to the rotary axes, a traveling direction of the linear body fed from the outlet of the temporarily storing means is slightly shifted in the lateral direction by the outlet side guide roller, then the linear body is guided to the inlet side guide roller, the shifting in the lateral direction is eliminated by the inlet side guide roller, and the linear body is thereafter guided to the inlet of the temporarily storing means.

[0012] According to such features of the present invention, when guiding the linear body from the outlet to the inlet of the temporarily storing means adjacent to each other, it is possible to effectively suppress deviation, collapse, bend and others of the linear body.

[0013] (4) The present invention further provides a temporary storage device for a linear body according to item (2) or (3) above, wherein abnormal tensile force detecting means for detecting occurrence of an abnormal tensile force when the abnormal tensile force is generated to the linear body is provided on the downstream side apart from the outlet of the temporarily storing means.

[0014] According to such features of the present invention, when an abnormal tensile force is generated to the linear body due to occurrence of derailment or the like of the linear body during traveling, this generation can be detected to effect emergency stop of traveling of the linear body.

[0015] (5) The present invention further provides a temporary storage device according to item (4) above, wherein the abnormal

tensile force detecting means comprises: an oscillating arm capable of oscillating around a central portion thereof; a detection roller which is rotatably supported at an end portion of the oscillating arm and reverses a traveling direction of the linear body when the linear body is wound therearound; a magnet which is provided at the other end portion of the oscillating arm and attracts a fixing member to hold the oscillating arm at a predetermined oscillating position; and a detection sensor which detects the oscillating position of the oscillating arm, and when an abnormal tensile force is generated to the linear body, the magnet is disengaged from the fixing member to allow the oscillating arm to oscillate from the predetermined oscillating position by an excessive oscillating force given to the detection roller from the linear body, and the oscillation of the oscillating arm is detected by the detection sensor.

[0016] According to such features of the present invention, the abnormal tensile force detecting means can be inexpensively manufactured with a simple configuration.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 is a schematic front view showing an embodiment according to the present invention;

[0018] FIG. 2 is a plan view of a temporary storage device;

[0019] FIG. 3 is a perspective view illustrating a state of winding a linear body around upper and lower rollers in the temporary storage device; and

[0020] FIG. 4 is a perspective view showing the vicinity of abnormal tensile force detecting means.

BEST MODE FOR CARRYING OUT THE INVENTION

[0021] An embodiment according to the present invention will now be described hereinafter with reference to the accompanying drawings. In FIGS. 1, 2 and 3, reference numeral 11 denotes a support frame which is set on a floor face 12 and extends in a substantially vertical direction, a winding roll 14 is rotatably supported at a central portion of this support frame 11 in the vertical direction through a bearing 13,

and this winding roll 14 comprises a cylindrical reel 15 and a linear body 16 wound around the reel 15 multiple times. Reference numeral 17 designates a wind-off roller which is supported at an upper end portion of the support frame 11, and the linear body 16 drawn from the winding roll 14 is wound around this wind-off roller 17. Further, upon receiving a driving force from a motor 18 fixed to the support frame 11, this wind-off roller 17 rotates and takes the linear body 16, and then sequentially winds off the linear body 16 while allowing traveling from the winding roll 14 at a low speed.

[0022] Here, although the linear body 16 comprises a ribbon-like body in which a small number of non-elastic cords extend in parallel with each other and are coated with coating rubber and a vertical groove is formed in a widthwise direction thereof in this embodiment, it may be one non-elastic cord coated with coating rubber or a ribbon-like body having a small number of non-elastic cords which bend flexuously and are coated with coating rubber.

[0023] Reference numeral 19 denotes a cylindrical forming drum which is set on one side of the support frame 11 and whose diameter can be increased or reduced, and this forming drum 19 is driven and rotated around an axial line parallel with the winding roll 14 by a non-illustrated drive mechanism. Furthermore, when this forming drum 19 is rotating, the linear body 16 which is wound off from the winding roll 14 and then split at the center in the widthwise direction is supplied to the both end portions of the forming drum 19 in the axial direction while being shifted in the axial direction, and then the linear body 16 is spirally wound around the outer sides of the both end portions of a belt layer in the axial direction to function as a belt reinforcing layer, the belt layer being attached to the forming drum 19.

[0024] Reference numeral 21 designates a temporary storage device set between the winding roll 14 and the forming drum 19, and this temporary storage device 21 is set on the floor face 12 and has a rectangular-frame-shaped fixed frame 22 extending from the support frame 11 toward the forming drum 19. A plurality of, which is two in

this example, upper roller groups 23 which are distanced in a right-and-left direction, i.e., a widthwise direction of the fixed frame 22 are provided at the upper end portion of this fixed frame 22, and each upper roller group 23 is supported by the fixed frame 22 and comprises a plurality of upper rollers 24 which are distanced from each other at equal intervals in the longitudinal direction of the fixed frame 22.

[0025] These upper rollers 24 are all arranged at the same height, and can freely rotate around rotary axes (axial lines parallel to a rotary axis of the winding roll 14) parallel to each other. In this example, each of these upper rollers 24 has flanges at both ends in the axial direction like a detection roller shown in FIG. 4, and comprises a roller with a crown whose diameter is increased toward the center in the axial direction, thereby effectively suppressing an accident of derailment of the linear body 16 from these upper rollers 24.

[0026] Reference numeral 26 denotes a plurality of pairs (two pairs) of guide rails which are provided at one end portion and the other end portion of the fixed frame 22 and extend in the vertical direction, and these two pairs of guide rails 26 are arranged separately in the lateral direction so as to correspond to the upper roller groups 23. Reference numeral 27 designates a plurality of (two) horizontal movable frames which extend in the longitudinal direction of the fixed frame 22, and these movable frames 27 are arranged apart in the lateral direction so as to correspond to the upper roller groups 23 and supported by the fixed frame 22 so that upward and downward movements thereof are allowed when both end portions thereof are slidably engaged with the guide rails 26. As a result, although the movable frames 27 move down by their own weights while being guided by the guide rails 26, springs, air cylinders or the like may be coupled with these movable frames 27 so that a weak downward impetus can be given to the movable frames 27.

[0027] Reference numeral 29 designates a plurality of (two) lower roller groups forming pairs with the upper roller groups 23, and these lower roller groups 29 are respectively arranged directly below the

upper roller groups 23. Each lower roller group 29 comprises a plurality of lower rollers 30 which are respectively supported by the movable frames 27, and each of these lower rollers 30 comprises a roller having the same shape as that of the upper roller 24 and can freely rotate around a rotary axis parallel with the rotary axis of the upper roller 24. Moreover, these lower rollers 30 are distanced apart from each other at equal intervals in the front-and-back direction and respectively arranged directly below spaces between the adjacent upper rollers 24. Additionally, when these lower rollers 30 integrally move up and down with the movable frames 27, the lower rollers 30 can be relatively set close to or apart from the upper rollers 24.

[0028] The upper roller groups 23 comprising the upper rollers 24 respectively arranged on the right-and-left side, the movable frames 27 and the lower roller groups 29 comprising the lower rollers 30 generally constitute temporarily storing means 32, and the plurality of (two in this example) temporarily storing means 32 are thereby installed and arranged apart from each other in parallel in the lateral direction (the right-and-left direction). Further, although the linear body 16 which is wound off and travels from the winding roll 14 is alternately and sequentially wound around the upper and lower rollers 24 and 30 of each temporarily storing means 32, since the upper and lower rollers 24 and 30 are distanced from each other in the up-and-down direction in this example, a festoon of the long linear body 16 is formed in each temporarily storing means 32.

[0029] Here, in this embodiment, each inlet N for the linear body 16 of the temporarily storing means 32a and b on the right side and the left side (the upper side and the lower side in FIG. 2) is positioned at the other end portion of each of the temporarily storing means 32a and b in the longitudinal direction and, on the other hand, an outlet X is positioned at one end portion of each of the temporarily storing means 32a and 32b in the longitudinal direction. As a result, the outlet X and the inlet N of each of the two adjacent temporarily storing means 32a and b are provided at one end portion and the other end portion of

each of the temporarily storing means 32a and b in the longitudinal direction, and the outlet X and the inlet N are largely distanced from each other in the substantially longitudinal direction of the temporarily storing means 32.

[0030] A guide roller 35 which is parallel to the lower rollers 30 is provided in the vicinity of the outlet X of the right temporarily storing means 32a, and this guide roller 35 is rotatably supported by the fixed frame 22. An outlet side guide roller 36 is rotatably supported by the fixed frame 22 directly below the guide roller 35 toward the right side, the outlet side guide roller 36 being slightly inclined toward the other side and being capable of freely rotating around the substantially horizontal rotary axis. On the other hand, a guide roller 37 which is parallel to the lower rollers 30 is provided in the vicinity of the inlet N of the left temporarily storing means 32b, and this guide roller 37 is rotatably supported by the fixed frame 22.

[0031] An inlet side guide roller 38 whose rotary axis is parallel to the outlet side guide roller 36 is rotatably supported by the fixed frame 22 directly below the guide roller 37, and this inlet side guide roller 38 can also freely rotate around the substantially horizontal rotary axis. Here, the rotary axes of the outlet side and inlet side guide rollers 36 and 38 are arranged on the substantially horizontal same plane, and a straight line connecting the center of the outlet side guide roller 36 in the axial direction with the center of the inlet side guide roller 38 in the axial direction is perpendicular to the rotary axes of these outlet side and inlet side guide rollers 36 and 38.

[0032] As a result, the linear body 16 fed from the outlet X of the right temporarily storing means 32a is sequentially wound around the guide roller 35 and the outlet side guide roller 36 so that its traveling direction is reversed (a direction change of approximately 180 degrees), its traveling direction is slightly shifted to a lateral direction which is a left direction in this example by the outlet side guide roller 36, and the linear body 16 linearly travels to be guided to the inlet side guide roller 38. When the linear body 16 guided to the inlet side guide

roller 38 in this manner is wound around the inlet side guide roller 38, the linear body 16 is restored to the proper traveling direction with the above-described shifting in the lateral direction being eliminated and, when the linear body 16 is sequentially wound around the inlet side guide roller 38 and the guide roller 37, its traveling direction is reversed, and the linear body 16 is led to the inlet N of the temporarily storing means 32b on the left side.

[0033] The above-described guide roller 35, outlet side guide roller 36, guide roller 37 and inlet side guide roller 38 generally constitute guiding means 39 which leads the linear body 16 supplied from the outlet X of one (right side) temporarily storing means 32a of the adjacent temporarily storing means 32 to the inlet N of the other (left side) temporarily storing means 32b. It is to be noted that each of these guide roller 35, outlet side guide roller 36, guide roller 37 and inlet side guide roller 38 is also constituted of a roller having the same shape as the upper roller 24.

[0034] Here, in case of temporarily storing the linear body traveling from one side toward the other side in the two temporarily storing means arranged in parallel with each other in the lateral direction, it can be considered that the following operation is usually performed. That is, the linear body is led to the vicinity of one end portion of the right temporarily storing means in the longitudinal direction, then a traveling direction of the linear body is reversed by winding the linear body around the two guide rollers which are distanced in the right-and-left direction and rotate around the vertical axes, and the linear body is thereafter led to the inlet provided at one end portion of the right temporarily storing means in the longitudinal direction.

[0035] Further, a festoon is formed in this temporarily storing means on the right side, then the linear body is supplied from the outlet provided at the other end portion in the longitudinal direction and wound around the two guide rollers which are distanced from each other in the right-and-left direction and rotate around the vertical axes so that a traveling direction of the linear body is reversed, and the

linear body is subsequently led to the inlet provided at the other end portion of the left temporarily storing means in the longitudinal direction. Furthermore, a festoon is formed in this temporarily storing means on the left side, and the linear body is then supplied from the outlet provided at one end portion in the longitudinal direction.

[0036] However, when trying to lead the linear body from the outlet of the temporarily storing means on the right side to the inlet of the temporarily storing means on the left side while reversing the traveling direction by the guide rollers which rotate around the vertical axes, the linear body is largely twisted by the guide rollers if the linear body is formed of a ribbon-like body having a width to some extent as described above, and consequently the linear body may come off the rollers, or collapse or bend may be generated in some cases.

[0037] On the contrary, as described above, when the outlet side and inlet side guide rollers 36 and 38 whose rotary axes are arranged on the substantially horizontal same plane and which have a straight line connecting the central parts in the axial direction being perpendicular to the rotary axes are respectively arranged in the vicinity of the outlet X and in the vicinity of the inlet N of the temporarily storing means 32a and b, a traveling direction of the linear body 16 supplied from the outlet X of the temporarily storing means 32a is slightly shifted in the lateral direction by the outlet side guide roller 36, the linear body 16 is then guided to the inlet side guide roller 38, the deviation in the lateral direction is subsequently eliminated by the inlet side guide roller 38, and the linear body 16 is thereafter led to the inlet N of the temporarily storing means 32b, whereby the number of twist given to the linear body 16 becomes small and, as a result, derailment, collapse, bend and others of the linear body 16 can be effectively suppressed when guiding the linear body 16 to the inlet N from the outlet X of the adjacent temporarily storing means 32, and a passing operation of the linear body 16 can be also facilitated.

[0038] In this manner, since a festoon is formed by alternately and

sequentially winding the linear body 16 around the upper and lower rollers 24 and 30 in all the temporarily storing means 32 and the linear body 16 is guided from one side toward the other side in the adjacent temporarily storing means 32, the same linear body 16 sequentially passes through all the temporarily storing means 32 while forming a festoon, whereby a total length of the linear body 16 which is temporarily stored in all the temporarily storing means 32 becomes very large. Moreover, when all the lower rollers 30 move down to the lowest position, a total length of the linear body 16 which is temporarily stored in the temporary storage device 21 becomes substantially equal to a product of a circumferential length of the forming drum 19 (a belt layer) and the number of times of winding of the linear body 16.

[0039] In FIGS. 1 and 4, abnormal tensile force detecting means 42 is arranged on the downstream side apart from the outlet X of the temporarily storing means 32 in the last column which is the temporarily storing means 32 on the left side, and this abnormal tensile force detecting means 42 is set on a horizontal support arm 43 fixed on the upper part of fixed frame 22 on one end surface thereof. This abnormal tensile force detecting means 42 has a fixing member constituted as a support plate 44 which is formed of steel and has a rectangular shape fixed on the upper surface of the support arm 44, and a pair of brackets 45 are attached on the upper surface of this support plate 44.

[0040] Reference numeral 46 denotes an oscillating pin supported by the brackets 45 at both end portions thereof, and a central portion of this oscillating pin 46 is inserted into the longitudinal central portion of the oscillating arm 47. As a result, the oscillating arm 47 can oscillate with the central portion, i.e., the oscillating pin 46 at the center. A detection roller 48 around which the linear body 16 supplied from the outlet X of the temporarily storing means 32b on the left side is wound is rotatably supported by an end portion of the oscillating arm 47, whereby a traveling direction of the linear body 16

is reversed by the detection roller 48.

[0041] On the other hand, a magnet 50 is attached at the other end portion of the oscillating arm 47, and this magnet 50 holds the oscillating arm 47 at a predetermined horizontal oscillating position when the magnet 50 attracts the support plate 44. In this example, when an abnormal tensile force is generated to the linear body 16 due to deviation or the like of the linear body 16 in the temporarily storing means 32, the downward oscillating force given to the detection roller 48 from the linear body 16 becomes excessive, the magnet 50 is disengaged from the support plate 44, and the oscillating arm 47 thereby oscillate with the oscillating pin 46 at the center in such a manner that the end thereof moves down from the predetermined oscillating position.

[0042] Reference numeral 51 designates a detection sensor which constantly detects an oscillating position of the oscillating arm 47 and, when the oscillating arm 47 oscillates to a position indicated by a virtual line in FIG. 4 and comes off the predetermined oscillating position due to an abnormal tensile force of the linear body 16 as described above, this detection sensor 51 detects oscillation of this oscillating arm 47, i.e., occurrence of the abnormal tensile force in the linear body 16, outputs a detection signal to non-illustrated controlling means, and performs emergency stop of rotation of the wind-off roller 17 and the forming drum 19 and traveling of the linear body 16.
The above-described support plate 44, brackets 45, the oscillating pin 46, oscillating arm 47, detection roller 48, magnet 50 and detection sensor 51 are generally provided on the downstream side apart from the outlet X of the temporarily storing means 32, and constitute the abnormal tensile force detecting means 42 which detects an abnormal tensile force when this abnormal tensile force is generated in the linear body 16.

[0043] Further, by providing the abnormal tensile force detecting means 42 on the downstream side apart from the outlet X of the temporarily storing means 32, when an abnormal tensile force is

generated in the linear body 16 due to deviation or the like of the linear body 16 during traveling, occurrence of this force can be detected to urgently stop traveling of the linear body 16, disconnection of the linear body 16, a damage to the temporarily storing means 32 and others can be avoided, and a recovery work can be rapidly carried out. Furthermore, when the abnormal tensile force detecting means 42 is constituted of the support plate 44, the brackets 45, the oscillating pin 46, the oscillating arm 47, the detection roller 48, the magnet 50 and the detection sensor 51 as described above, the abnormal tensile force detecting means 42 can be inexpensively manufactured with a simple configuration.

[0044] Reference numeral 55 denotes a guide roller rotatably supported by the fixed frame 22 immediately below the abnormal tensile force detecting means 42; 56, a guide roller rotatably supported by the support arm 43 on one side apart from the abnormal tensile force detecting means 42; and 57, a guide roller which is set between the guide roller 56 and the forming drum 19 and capable of free rotation, and the linear body 16 passes through the detection roller 48 of the abnormal tensile force detecting means 42, is then wound around the guide rollers 55, 56 and 57 and supplied to the forming drum 19. Here, the linear body 16 is cut along a vertical groove at the center in the widthwise direction and divided into two in the widthwise direction by dividing means 61 including a cutter set at one end portion of the fixed frame 22 while passing through the space between the guide roller 55 and the guide roller 56.

[0045] Moreover, the linear bodies 16 divided in this manner are respectively spirally wound around the outer sides of the both end portions in the widthwise direction of the belt layer attached to the forming drum 19, thereby serving as a belt reinforcing layer. Additionally, when the linear body 16 is divided into two along the widthwise direction in this manner, tensile forces in these divided pieces may be affected by the forming drum 19 or the like to become different from each other but, in such a case, tensile force correcting

means 62 attached to the fixed frame 22 between the dividing means 61 and the guide roller 56 performs correction so that the tensile forces become equal to each other.

[0046] The functional effects of the embodiment according to the present invention will now be described.

[0047] It is assumed that a tire constituent member such as a carcass ply or a belt ply is supplied to the forming drum 19 and attached on the outer periphery of the forming drum 19. On this occasion, when the wind-off roller 17 rotates by the motor 18, the linear body 16 fed from the winding roll 14 at low speed is supplied to the plurality of temporarily storing means 32, two in the illustrated embodiment, and the linear body 16 supplied to the temporarily storing means 32 in this manner is temporarily stored while being alternately and sequentially wound around the upper and lower rollers 24 and 30 of each temporarily storing means 32 to form a festoon.

[0048] When the linear body 16 is sequentially supplied to the temporarily storing means 32 from the winding roll 14 in this manner, the movable frames 27 and the lower rollers 30 move down while being guided by the guide rails 26 so that a length of the festoon is gradually increased but, if the linear body 16 is, e.g., sidetracked in the temporarily storing means 32 and an abnormal tensile force is generated to the linear body 16, the magnet 50 is disengaged from the support plate 44, and hence the oscillating arm 47 oscillates with the oscillating pin 46 at the center in such a manner that the end thereof moves down. When the oscillating arm 47 oscillates in this manner, the detection sensor 51 detects the oscillation and urgently stops rotation of the wind-off roller 17 and the forming drum 19 and traveling of the linear body 16.

[0049] Moreover, when the lower rollers 30 move down to the lowest position by supply of the linear body 16, a total length of the linear body 16 which is temporarily stored in the temporary storage device 21 becomes substantially equal to a product of a circumferential length of the forming drum 19 (or of the belt layer) and the

number of times of winding of the linear body 16, and the elongate linear body 16 is temporarily stored in the temporary storage device 21.

[0050] Here, by adopting a configuration in which the temporary storage device 21 is constituted by arranging the plurality of temporarily storing means 32, two in the illustrated embodiment, parallel with each other in the lateral direction and the linear body 16 is led from the outlet X to the inlet N of the adjacent temporarily storing means 32, the same linear body 16 sequentially passes through all the temporarily storing means 32 while forming a festoon so that, when the length of the linear body 16 which is temporarily stored is the same, the longitudinal length of the temporary storage device 21 can be made rather shorter as compared to the conventional device and, more specifically, the longitudinal length of the temporary storage device 21 can be shortened approximately to a length obtained by dividing the longitudinal length of the conventional device by the number of the temporarily storing means 32, two in the illustrated embodiment, whereby the temporary storage device 21 can be generally formed compact and easily installed also in existing equipments.

[0051] Additionally, when the linear body 16 having the above-described length is temporarily stored in the temporary storage device 21, although the wind-off operation of the linear body 16 from the winding roll 14 is stopped and the linear body 16 is drawn from the temporarily storing means 32 at a high speed, the linear body 16 drawn from the temporarily storing means 32 in this manner is divided into two in the widthwise direction by the dividing means 61, and the divided linear bodies 16 are then supplied to the forming drum 19 and respectively spirally wound around the outer sides of the both end portions in the widthwise direction of the belt layer on the forming drum 19, thereby serving as a belt reinforcing layer.

[0052] Incidentally, in the foregoing embodiment, winding of the linear body 16 around the forming drum 19 is stopped when the linear body 16 is supplied from the winding roll 14 and temporarily stored in

the temporary storage device 21 and, on the other hand, the wind-off operation of the linear body 16 from the winding roll 14 is stopped when the linear body 16 is wound around the forming drum 19, but the linear body 16 may be wound off from the winding roll 14 at a low speed while winding the linear body 16 around the forming drum 19 in the present invention.

[0053] Further, in the foregoing embodiment, the length of a festoon formed by the linear body 16 in the temporary storage device 21 is increased by moving down the lower rollers 30, though the length of the festoon formed by the linear body may be increased by stopping the lower rollers while moving up the upper rollers in the present invention. Furthermore, the linear body 16 is divided into two and the divided linear bodies are respectively spirally wound around the outer sides of the both end portions in the widthwise direction of the belt layer to serve as a belt reinforcing layer in the foregoing embodiment, though the linear body may be spirally wound and superimposed on the belt layer without being divided.

INDUSTRIAL APPLICABILITY

[0054] The temporary storage method and device according to the present invention can be used for forming tires.